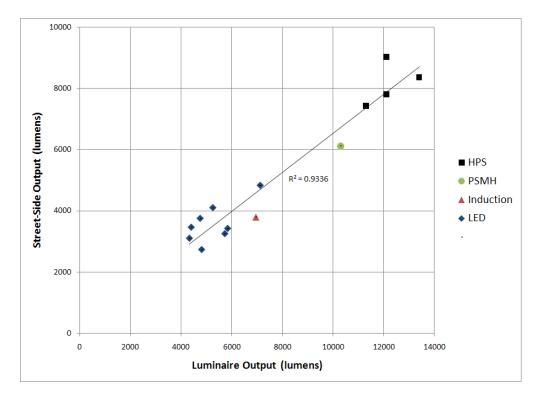
U.S. Department of Energy Review of the Lighting Research Center's New Specifier Report On Streetlights for Collector Roads

October 22, 2010

We have received a number of inquiries from manufacturers, users, and the media regarding the findings of a recently released report from the NLPIP¹, and thus have looked into the report in further detail. Some initial findings from this review follow.

In simple terms, the NLPIP report defines a theoretical road, sets the lighting criteria as IES RP-8, supplies IES photometric files for an NLPIP-selected set of luminaires, and then allows lighting software to vary the pole spacing to meet the criteria in that one design situation. Some of the products are found to require more luminaires (and thus more poles and related expense) to meet the criteria than others. The results of this simulated exercise then drive all the subsequent energy use and life-cycle cost estimates, and resulting findings and conclusions of the report.

LRC commits a critical error at the outset of the study which then permeates the remainder of the report. The issue is easily visible in the figure below, which plots "street-side output in lumens" (LRC's measure of choice) against total luminaire output for the various products evaluated.



¹ National Lighting Product Information Program (NLPIP) Specifier Reports, "Streetlights for Collector Roads," Volume 13 Number 1, September 2010.

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The nearly linear distribution of points in the graph reveals that the LED and induction products selected by NLPIP for this analysis were simply (and dramatically) underpowered for this application. Selection of higher powered LED and induction products appropriate for this application, which are widely available in the market, would have offered correspondingly higher luminaire output, and made possible a fair comparison with the selected HPS products.

As it stands, this basic flaw in the LRC methodology cascades through the report's conclusions and entirely undermines the general statements made about LED performance. The conclusions about LED systems needing more luminaires and poles, and consequently having much higher first costs, follow directly from this selection error and are thus baseless.

We found a number of additional issues/flaws, though they are largely moot after the critical error noted above. A few of these are listed below.

- LRC has tested all HPS and PSMH luminaires using relative photometry and the LED and induction luminaires using absolute photometry. A side bar on page 11 explains the difference between absolute and relative, and states, "NLPIP tests showed that the measured lumens of the four HPS lamp and magnetic ballast combinations (measured independently of the streetlight) were, on average, 10% lower than their rated lamp lumens..." Yet, the report does not de-rate the results of the relative photometry on the luminaires by this 10% (although it does go to lengths in Appendix A to explain other factors taken into consideration). CALiPER absolute testing has similarly shown that in the majority of cases for conventional light source technology fixtures, actual luminaire performance (based on absolute photometry) is less than predicted by relative photometry by a factor of 10-15%. The report's failure to apply a correction factor to the results for this known discrepancy introduces a significant bias.
- The authors fundamentally assume that house-side lumens are by definition "wasted lumens." There are many applications where the "house-side" lumens actually provide superior roadway visibility, e.g., in wet pavement where the house-side lumens are not reflecting towards the driver so provide better visibility of the edge of the road. House-side lumens also don't result in veiling glare for the driver the way that street-side lumens do. Some might even contend that given the presence of headlights on cars, a street lighted with house-side lumens would provide superior roadway visibility than a street lighted only with street-side lumens (e.g., see Rea, M. S. 2001. The Road Not Taken. The Lighting Journal 66(1):18-25.)
- IES explicitly discourages over-reliance on the "Type" classification system established in TM-3. If LRC selected LED luminaires on the simple basis of Type III Medium rating, there's a good chance superior products were inadvertently eliminated from consideration.
- LRC inadvertently ordered a Type I luminaire and never caught the mistake. This is why the Holophane luminaire produced the shortest HPS pole spacing.
- The authors are apparently unaware that the (recently deprecated) "cutoff" classification system cannot be applied to absolute photometry, e.g., LED luminaires

tested per LM-79. Unfortunately, the Photometric Toolbox software NLPIP used for the analysis reports a modified version of the "cutoff" classification system when it encounters absolute photometry, simply replacing lamp lumens with luminaire lumens for the divisor, without utilizing a different naming convention. A consequence of this non-standard calculation is that an HID luminaire classified "Full Cutoff" when tested using relative photometry can be classified "Cutoff" or worse when tested using absolute photometry. (LED luminaires are thereby put at an unfair disadvantage in the study.)

• The Hadco and elumen luminaires appear to be the same product, effectively reducing the number of LED luminaires evaluated by one. Additionally, both products allow field-adjustment of light distribution (setpoints of 0, 4.5, 9, 13.5, 18, or 22.5 degrees), but LRC does not indicate which setting was used during testing. According to Hadco, the luminaire changes from Type II to Type III by changing the tilt of the light sources from 13.5 degrees to 18 degrees.